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G. E. EHRLICH (1995) LTD.
c/o ANTHONY CASTORINA
SUITE 207
2001 JEFFERSON DAVIS HIGHWAY
ARLINGTON, VA 22202

EXAMINER	
FERRIS III, FRED O	
ART UNIT	**PAPER NUMBER**
2128	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/746,014	GOLDMAN ET AL.	
	Examiner	Art Unit	
	Fred Ferris	2128	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *2 August 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-10,13-24 and 27-33* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-10,13-24 and 27-33* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *11 May 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. Claims 1-10, 13-24, and 27-33 are currently pending in this applications and have been presented for examination based on applicant's amendment filed on 2 August 2005. Claims 1-10, 13-24, and 27-33 remain rejected.

Response to Arguments

2. Applicant's arguments filed 2 August 2005 have been fully considered.

Regarding applicant's response to 101 rejection: The examiner withdraws the 101 rejection of claim 15 in view of applicant's amendment to the claims and arguments filed 22 November 2004.

Regarding applicant's response to objection to claims 9 & 21: The examiner withdraws the objection to claims 9 & 21 in view of applicant's amendment to the claims.

Regarding applicant's response to 35 USC 102(b) rejections: The examiner withdraws the 102(b) rejection in view of applicant's amendment to the claims.

Regarding applicant's response to 35 USC 103(a) rejections: Applicants arguments that the prior art does not teach the use of orthogonally placed points (i.e. at right angles) are not persuasive since no such limitations are specifically recited in the rejected claim(s). (The claim limitations only require that the points be geometrically spaced) Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See In re Van Geuns, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). Applicant's arguments that a skilled artisan would not be motivated combine the teaching de Ward because the field is unrelated, are also not

persuasive, since applicants specification specifically recites that silicon wafer production provides an example of an automatic product process requiring a fully comprehensive model using predictive methods such as those of the present invention. (Specification page 2, lines 5-7) De Ward and Tsai similarly teach predictive modeling in semiconductor processing and are therefore not unrelated.

The examiner submits that the amendment to the claims has not rendered the claimed subject matter non-obvious over the prior art of record for the reasons set forth herein and below under 35 USC 103(a) rejections. Amended limitations are now addressed below. Accordingly, the 103(a) rejection of claims 1-10, 13-24, and 27-33 is maintained.

Applicant's amendment to the preamble of the claims has not been given patentable weight. Appropriate weight is given to limitations recited in the body of the claim that are needed for purpose of antecedence. "A mere statement of purpose or intended use in the preamble of a claim need not be considered in finding anticipation; however, it must be considered if the language of a preamble is necessary to give meaning to the claim" Diversitech Corp. v. Century Steps, Inc., 7 USPQ2d 1315 (Fed. Cir. 1988); In re Stencel, 4 USPQ2d 1071 (Fed. Cir. 1987)

The examiner has also now applied new 35 USC 112(1) rejections responsive to applicant's amendment to the claims. (See below)

Claim Interpretation

3. Applicants are disclosing a system and method for automatic process control using design of experiments (DOE) techniques by analyzing input space comprising boundaries (empirical data) to a process model during simulation. The examiner notes that applicants appear to have broadly claimed the use of DOE in automatic process control using based well-known DOE concepts when simulating the behavior of a process model. (see: Kleihnen section I, II, for example) Further, the claimed limitations relating to the measurement unit, controller, and regressor were known in the art and available to a skilled artisan at the time of the invention, and are features generally inherently available in the numerous commercially available DOE software packages such as STATISTICA, Design-Expert, SimProcess, CARD. These features are also available as add-ons to the popular MatLab, ANSYS, and ChemDraw programs. Applicants have acknowledged this in amendment of 22 November 2004 page 14, line 10 to page 15, line 14. Accordingly, the examiner has as interpreted the elements of, and hence the functions performed by, the measurement unit, controller, and regressor, to be necessarily inherent elements of the prior art and any of these commercially available DOE software packages. While such features are generally standard features of the commercially available DOE software packages noted above (see: Angel Section 2, table 1, for example), applicants are invited to explain any specific novel aspects of the claimed limitations over the prior art.

Claim Rejections - 35 USC § 112

4. Claims 1-10, 13-24, and 27-33 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Specifically amended independent claims 1, 15, and 24 now claim elements that do not appear to be supported the specification. They are:

- *"online optimization" (claims 1, 15, and 24): The specification appears to be silent on how any "online optimization" would be accomplished by the claimed invention. Here, the examiner interprets the term "online" to mean connected to the Internet (Microsoft Computer Dictionary, 1997) but no techniques for practicing the DOE optimization process of the claimed invention over the Internet are recited in the specification.*
- *"model based controller" (claim 15): The specification does not appear to specifically disclose a "model based controller" or the operation thereof.*

Dependent claims 22-10, 13-14, 16-23, and 27-33 inherit the defects of the claims from which they depend.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

5. Claims 1-10, 13-24, and 27-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 5,781,430 issued to Tsai in view of U.S. Patent 6,373,033 issued to de Waard et al, in further view of U.S. Patent 6,725,112 issued to Kaminsky et al, and in further view of applicant's admission that the claimed measurement unit, controller, and regressor were known in the art and available to a skilled artisan at the time of the invention. (applicant's amendment 22 November 2004 page 14, line 10 to page 15, line 14)

Independent claim 1, for example, is drawn to:
Automatic process control of input space with boundaries comprising:
process measurements at selected input space points (measurement unit)
selecting input space points to maximize information (controller)
obtaining predictive input space process model from measurements (regressor)

Regarding independent claims 1, 15, and 24: Tsai discloses the elements of the claimed limitations of the present invention as previously cited above and as follows:

- Automatic process control of input space with boundaries comprising: (Summary, Objectives I, II, III, Methods I, II, III See: CL3-L50-CL7-L39, CL13-L36-CL18-L26. CL18-L27, Figs. 4, 8, 9-17)

- process measurements at selected input space points (i.e. measurement unit): (Summary, Objectives I, II, III, Methods I, II, III See: CL3-L50-CL7-L39, CL13-L36-CL18-L26. CL18-L27, CL19-L17-50, Figs. 4, 8, 9-17)

- selecting (selector) input space points to maximize information: (Summary, Objectives I, II, III, Methods I, II, III See: CL3-L50-CL7-L39, CL13-L36-CL18-L26. CL18-L27, CL19-L17-50, Figs. 4, 8, 9-17) Number of (predetermined/selected) points (CL17-L24-65). Tsai discloses processes executed by the DOE module, RSM module, and PWO module in Figures 8 and 9 (also see Objectives I, II, III, Methods I, II, III CL18-L31 to CL19-L14 as noted above). Tsai further discloses an empirical mapping function (claim 15) for the operating points (input/output) of the process (Method 1, CL13-L37-62) and running an experimental operation of a process (CL18-L31-67, Fig. 9).

Tsai does not explicitly teach a predictive modeling process from measurements.

De Waard discloses the elements of the claimed limitations of the present invention as follows:

- obtaining predictive input space process model from measurements (i.e. a regressor): de Waard discloses a predictive model of a process developed from process measurements. (CL9-L38, CL10-L24-35, CL10-L39, CL15-L19, Figs. 6, 14A-21) de

Waard further discloses the use of auto-regression and a measurement controller (i.e. to carry out measurements) in model development. (Abstract, Summary of Invention, CL9-L38-65, Figure 5)

- controller for process to produce measured outputs at selected points: De Waard teaches a control system for measured process inputs (Figs. 4, 5, CL9-L55-CL10-15) and producing responsive outputs. Tsai teaches (predetermined/selected) points as noted above.

While Tsai does not explicitly disclose a measurement unit, controller (model-based), or regressor, per se, the examiner submits that these features to be functionally equivalent to the features provided by the DOE module, RSM module, and PWO module in Figures 8 and 9 as noted above. (also see Objectives I, II, III, Methods I, II, III CL18-L31 to CL19-L14 as also noted above).

Applicants have admitted that the elements of the measurement unit, controller, and regressor were known in the art and available to a skilled artisan at the time of the invention. (applicant's amendment 22 November 2004 page 14, line 10 to page 15, line 14)

It would have been obvious to one having ordinary skill in the art at the time the claimed invention was made to modify the teachings of Tsai relating to DOE and automatic process control of input space with boundaries, with the teachings of De Waard relating to developing a predictive modeling process from measurements, to realize the claimed invention. An obvious motivation exists since this area of technology is highly competitive with many types of DOE process modeling techniques

and products available in the market place, and large amounts of money being spent in product development and improvement. (see: D. Boning, Kleijnen, Harlow Introduction/Conclusion, for example) Accordingly, a skilled artisan would have made an effort to become aware of what capabilities had already been developed in the market place and, hence, would have been knowingly modified the teachings of Tsai with the teachings of de Waard and to further modified the teachings of Tsai to include the elements of the measurement unit, controller, and regressor as were known to one skilled in the art, in order to realize the elements of the claimed invention and gain the advantage of reduced development time and cost.

The combination of Tsai and De Waard further does not explicitly disclose that the DOE optimization be online (i.e. via the Internet).

Kaminsky teaches DOE process optimization inclusive of a DOE media set up application operating over the Internet (CL8-L39-44, Fig. 14).

It would have been obvious to one having ordinary skill in the art at the time the claimed invention was made to further modify the combined teachings of Tsai and De Waard, with the teachings of Kaminsky relating to DOE process optimization inclusive of a DOE media set up application operating over the Internet using the same reasoning cited above. Further motivation is provided in that the Internet is the de factor standard for world wide data exchange (Microsoft Computer Dictionary, 1997) and hence would have knowingly been incorporated by a skilled artisan.

Regarding dependent claims 2-10, 13, 14, 16-23, and 27-33: This group of dependent claims includes additional limitations relating to process modeling which are rendered obvious by the prior art as follows:

- *predictive modeling: de Ward – (Abstract, Summary, CL9-L38, CL10-L24-33, 39, CL15-L19, Figs. 6, 14A-21)*
- *geometric spacing: Tsai - (Summary, Objectives I, II, III, Methods I, II, III See: CL3-L50-CL7-L39, CL13-L36-CL18-L26. CL18-L27, CL19-L17-50, Figs. 4, 8, 9-17)*
- *boundary points: Tsai - (Summary, Objectives I, II, III, Methods I, II, III See: CL3-L50-CL7-L39, CL13-L36-CL18-L26. CL18-L27, CL19-L17-50, Figs. 4, 8, 9-17)*
- *linear/quadratic formulas: de Ward – (CL10-L49 to CL17-L59, Fig.6)*
- *quality assessment: de Ward – (CL10-L25-33)*
- *The claimed empirical data is merely information based on observation and experience (i.e. part of any Taguchi DOE model) and would obviously be considered as part the "input" disclosed in the prior art. (see: Harlow Section III, for example)*
- *Applicants have also admitted that the elements of, and hence the functions performed by, the measurement unit, controller, and regressor were known in the art and available to a skilled artisan at the time of the invention.*

(applicant's amendment 22 November 2004 page 14, line 10 to page 15, line 14)

Conclusion

6. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, ***THIS ACTION IS MADE FINAL****. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).*

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

"DOE/Opt: A System for Design of Experiments, Response Surface Modeling, and Optimization Using Process of Device Simulation", D. Boning, IEEE Transactions on

Semiconductor Manufacturing, Vol. 7, No. 2, May 1994 discloses DOE and automatic process control.

"Design of Experiment is the best way to Optimize a Process at Minimal Cost", S. Kumar, IEEE/CHMT '90 IEMT Symposium, pp 166-173, IEEE 1990 discloses DOE and automatic process control.

"Validation of Models: Statistical Techniques and Data Availability", Kleijnen, Proceedings 1999 Winter Simulation Conference, pp. 647-654, ACM 1999 discloses DOE and automatic process control.

"Design of Experiments in BDD Variable Ordering: Lessons Learned", Harlow et al, ICCADA 98', pp. 646-652, ACM 1998 discloses DOE and automatic process control.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Fred Ferris whose telephone number is 571-272-3778 and whose normal working hours are 8:30am to 5:00pm Monday to Friday. Any inquiry of a general nature relating to the status of this application should be directed to the group receptionist whose telephone number is 571-272-3700. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jean Homere can be reached at 571-272-3780. The Official Fax Number is: (703) 872-9306

Fred Ferris, Patent Examiner
Simulation and Emulation, Art Unit 2128
U.S. Patent and Trademark Office
Randolph Building, Room 5D19
401 Dulany Street
Alexandria, VA 22313
Phone: (571-272-3778)
Fred.Ferris@uspto.gov
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